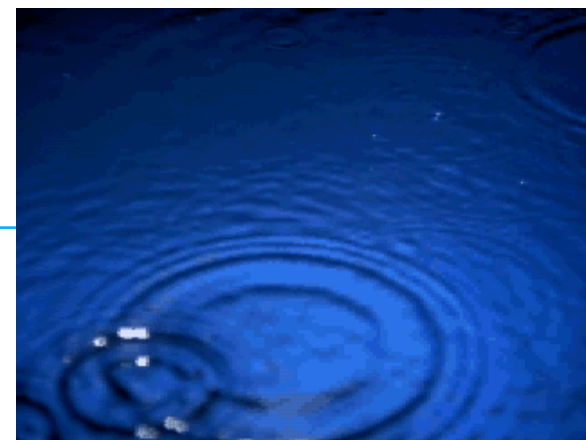


# *Global Precipitation Measurement*

***System Definition Review***

***System Safety and Mission Assurance***

***December 6-8, 2005***

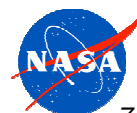


*Tom Toutsis 301/286-3444  
Thomas.S.Toutsis@nasa.gov  
Goddard Space Flight  
Center*



- **Mission Assurance Team**

- Safety *Jamie Burget, Jim Anderson*
- Reliability *Lydia Lee, Nino Ingegneri*
- EEE Parts *Rich Williams*
- Materials *Chuck Powers*
- Software Assurance *Gary Jordan*
- Quality Assurance *Ed Mitchell*
- Contamination *Larry Ramsey*



- ***The Mission Assurance Requirements (MARs) will consist of four MAR's as follows:***
  - *Core Spacecraft*
  - *GMI Instrument*
  - *Constellation*
  - *Ground Data Systems*
- ***The DPR Mission Assurance Requirements will be included in the ICD***



- ***The GPM Mission Assurance Core Spacecraft Requirements (MAR) # 422-40-01-004 and the GPM Microwave Imager (GMI) MAR # 422-10-05-002 have been completed.***
  - *Quality Assurance*
  - *System Safety*
  - *Reliability*
  - *Software Assurance*
  - *EEE Parts*
  - *Materials Processes*
  - *Technical Reviews*
  - *Verification*
  - *Risk Management*
  - *Workmanship Standards*
  - *Contamination*





- ***The DPR ICD will include mission assurance requirements***
  - *All safety requirements are applicable*
  - *A interface FMEA that identifies any failure modes that could propagate to the spacecraft*
  - *Numerical reliability assessment*
  - *Materials to meet the outgassing, atomic oxygen contamination requirements*
  - *Report failures that effect performance, interface or schedule*
  - *EEE parts level 2 is required per GSFC EEE-INST-002*
  - *GSFC System Review Office will participate in the DPR interface design reviews*
  - *Verification plan that prescribes tests and analyses which will demonstrate that hardware and software comply with environmental requirements*



- ***Mission assurance requirements (MAR) for the ground data systems # 422-10-05-005 has been completed***
  - *Mission operations system*
  - *Precipitation processing system*
  - *Ground validation system*
  - *The GDS MAR requires a plan from each system that addresses the requirements, design, implementation, test, operations and maintenance of hardware and software*
  - *Each plan addresses Government Off The Shelf (GOTS), off the shelf (OTS), commercial off the shelf (COTS)*



- ***Hardware will be fabricated to approved workmanship standards***
- ***A closed loop system for identifying and reporting nonconformances is required***
  - *The in house PR/PFR system will be used*
  - *Contractors use their own internal nonconformance procedures*
- ***GSFC in house ISO procedures are applicable***

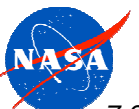


- **Reliability analyses**
  - *Failure modes and effect analysis (FMEA) and critical items list (CIL)*
  - *Fault tree analysis*
  - *Worst case analysis*
  - *Numerical reliability assessment*
- **A probabilistic risk assessment (PRA)**
  - *Uses input from reliability analyses to identify undesirable events, the scenarios leading to those events, the frequency or likelihood of those events and the event consequences*
  - *NPR 8705.5 probabilistic risk assessment procedures for NASA programs and project*
- **GSFC reliability will integrate the instrument and avionics reliability information to develop a mission level reliability assessment.**





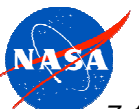
- **System Safety Program Plan (SSPP)**
  - Describes the safety implementation process
- **Safety Documentation Prepared In-House**
  - Will assimilate inputs from Instrument and Avionics vendor
- **Major Documents:**
  - Preliminary Hazard Analysis
    - Inputs from Instrument and Avionics vendor as Safety Assessment Reports (SAR)
  - Safety Data Package (SDP)
    - Phase 0/I@PDR, II@CDR, III@PSR
    - Includes:
      - PHA
      - Hazard Reports will be generated
      - Safety Requirements Compliance Checklist
        - Verifies the flight hardware, GSE and Operations meets the launch site safety requirements
      - Verification Tracking Log(VTL with Phase III SDP)
      - Safety Variances (Approved individually, tracked with SDP)



- **Operations Hazard Analysis**
  - *I&T operations at GSFC*
- **Operating and Support Hazard Analysis (O&SHA)**
  - *Evaluates hazards during the prelaunch processing*
- **Ground Operations Procedures (GOP)**
  - *Procedures used at Goddard reviewed/approved by Code 302*
  - *Goddard-approved prior to use at Range*
- **Orbital Debris Assessment (ODA)**
  - *NPD 8710.3 Policy for limiting Orbital Debris Generation*
  - *NSS 1740.14 Guidelines and Assessment Procedures for Limiting Orbital Debris*
  - *Due at MPDR (preliminary) and MCDR (final)*

### **Code 302 Letter of Safety Certification**

- *Prior to shipment of Observatory to the Launch Site*



- ***Software quality assurance will be implemented as part of the software development process***
- ***The NASA independent verification and validation team will participate in the flight software development***
  - ***IV&V to perform startup criticality assessment of GMI and core spacecraft in early 2006***
    - ***Identify risk areas***
    - ***Funding allocation***
    - ***IV&V schedule***
    - ***IV&V contractor involvement April 2006***
  - ***DPR software assurance will be delineated in MOU***
- ***Software verification and validation will be performed during each phase of the software life cycle***
- ***Software safety- new software assurance requirement per NPR 7150.2, the GPM project is working with Code 300 to develop a set of best practices describing the processes which should be implemented to satisfy the software safety requirement***



- ***GSFC 311-INST-002 instructions for EEE parts will be applied to select, screen and qualify parts for a quality level 2 mission***
- ***The standard GSFC materials and processes requirements are applicable***
  - *Vacuum outgassing*
  - *Flammability and toxic offgassing*
  - *Stress corrosion cracking*





- ***A contamination control program that establishes the cleanliness requirements will be required.***
- ***A GPM contamination control plan will delineate the methods used to meet the cleanliness requirements***



**Day 1 - December 6, 2005**

**Location: NASA GSFC B16W-N76/80**

<b>Time</b>	<b>Section</b>	<b>Event</b>	<b>Presenter</b>
8:30 AM		Logistics & Announcements	Durning
8:35 AM	1	Introduction	Durning/Ho
8:45 AM		Charge to Review Team/RIDs: Purpose & Review Criteria	Ho
8:55 AM		HQ Overview	Neeck
9:10 AM	2	GPM Mission Overview	Durning
9:55 AM	3	Science Requirements	Hou
<b>10:25 AM</b>		<b>Break</b>	
10:40 AM	4	Mission Requirements	Bundas
11:10 AM	5	Mission Architecture	Bundas
<b>11:55 AM</b>		<b>Lunch</b>	
12:55 PM	6	Systems Engineering Processes	Bundas
1:40 PM	7	System Safety and Mission Assurance	Toutsi
1:55 PM	8	External Interfaces	Hwang
2:10 PM	9	Dual Precipitation Radar (DPR) Overview/Requirements	Woodall
<b>2:55 PM</b>		<b>Break</b>	
3:10 PM	10	GPM Microwave Imager (GMI) Overview/Requirements	Flaming/Bidwell
4:10 PM	11	H-IIA Launch Vehicle	Woodall
4:30 PM		Review Team Caucus	
<b>4:40 PM</b>		<b>End of Day 1</b>	

